Conclusions: PBC calculates hot spot dose-volume less accurate than AAA in HT tissues. Therefore hot spot information is not precise in PBC plans than AAA plans and max dose constrains could be above than intended. Additionally, PBC could calculate OAR doses less than actual, which might cause over doses and morbidity in some OARs, such as spinal cord. Consequently AAA should be preferred to PBC for target including HT such as lung.

EP-1191

Study and validation of a deterministic model for energetic particles transport. Application in radiotherapy.

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Purpose/Objective: More accurate and complex radiation techniques are required in order to improve the dose distribution over the target volume while sparing organs at risk. The development of new dose calculation algorithms which are both more accurate and faster than those used in clinical routine is required. Along with statistical methods like reduced (fast) Monte Carlo, we propose an alternative method based on a deterministic approach which provides advantage in reduced cost and improved precision.
Materials and Methods: Our deterministic algorithm is based on the solution of Fokker Planck equation by using the multi-group in energy method combined with a specific angular momentum closure. For each energy-group, the equations for 2 angular moments are closed with the algebraic relation deduced from the principle of entropy minimization. (1)
This method is already implemented in the plasma physics community for description of the energetic electron and photon transport combining good efficiency and precision. CELIA laboratory has developed a computing platform dedicated for validation of this algorithm for medical applications validation. Two aspects are considered : dose deposition calculation and optimization of the treatment plans.
(1) Dubroca, Feugeas, Frank, Angular moment model for the Fokker-Planck equation, Eur. Phys. J. D 60 (2010) 301–307
Results: This deterministic code is compared to direct Monte-Carlo simulations using Geant4 and Penelope in the case of homogeneous and heterogeneous phantoms (water and bone media). It shows good precision in dose deposition and very short calculation time. We also present the results of an experimental campaign of sources characterizations on linear medical accelerators (energy spectrum). These data were implemented in the code for dose calculations.
Conclusions: This work is the result of a multidisciplinary and transversal collaboration involving laboratories in fundamental physics, applied mathematics and cancer centers in the framework of a regional project with European financial grants started in 2011. The promising results obtained for electrons transport will be further extended to photons. The algorithm in dose optimization process is now under development.

EP-1192

Commissioning of the Elekta OmniWedge™ system

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Purpose/Objective: The wedge remains the most frequently used beam modifying device in non-IMRT treatments. In ELEKTA linacs, a fixed angle mechanical wedge is placed in the head; arbitrary wedge angles can be achieved by using the wedge for part of the treatment. In this technique (called motorized wedge),only one wedge direction is provided; this direction is orthogonal to the leaves' direction in the multileaf collimator (MLC). As a result, concomitant use of MLC and a wedge can lead to conflicts with the optimal collimator angle. In addition, the motorized wedge technique results in a high number of monitor units (MU), producing a significant amount of scatter dose. To overcome these problems, ELEKTA provides the OmniWedge system,which makes use of the motorized wedge and a dynamic wedge. The OmniWedge is a built-in mode in the PrecisePlan Treatment Planning System (TPS). The purpose of this work is to present the commissioning of the system.
Materials and Methods: We measured wedge factors and dose profiles as function of depth, field size, wedge angle and wedge orientation. The measurements were performed for the Elekta Precise™ linac equipped with 6 and 18MV photon energies, at a fixed SSD = 100cm. Wedge factor measurements were done in a solid water phantom RMI457 using a Farmer 2571 ion chamber and a PTW Unidos electrometer. Because the dynamic wedge was of particular interest, wedge factors for this option (i.e. OmniWedge oriented by 90^0) were measured for field sizes 5x5,10x10, and 15x15 cm^2, wedge angles of 15°, 30°, and 45°, at depths of 5, 10, and 15 cm. For other OmniWedge orientations, fewer beams were selected to reduce workload. Profile measurements were done for 9 different combinations of wedge angles and orientations, field sizes and depths using the IBA I'm*RT* MatriXX system. TPS calculation accuracy was verified by comparison of measured and calculated doses.
Results: The ratio between the measured and calculated wedge factors (WF_M/WF_C) was derived. For the dynamic wedge mode, the ratio WF_M/WF_C was in the range 0.99 to 1.01 for both energies. For the OmniWedge mode, the results were less consistent but the discrepancy remained less than4%. Profiles comparisons between measured and calculated ones were also performed. In general, the differences between the profiles are subtle in the central region and get bigger at the edges of the fields.
Conclusions: Comparison of measured and calculated data showed high correspondence between the two. In light of the above,we have successfully implemented the OmniWedge technique in our department. The use of OmniWedge offers the benefit of optimal collimator angle and fewer MUs needed for many usual cases.

EP-1193

Monitor units checking for complex 3D treatment plans based on PDF and JavaScript

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Purpose/Objective: Trustworthy checks of TPS calculated dose values are workaday life in medical physics routine of every radiotherapy department. 3D treatment planning is more and more complex. And due to quality assurance (QA) requirements[1] a TPS independent calculation proof of correct monitor units (MU) is obligatory. 3D TPS plans for Elekta® and Varian® linacs use static, motorized and dynamic wedges. Treatment plans contain excentric irregular fields where the normalization point is not identical to the geometric isocenter. An easy to use method based on dosimetric measurements of linac beam parameters are implemented to realize QA monitor unit checks of complex 3D plans. In particular it is important to assure that on the minimal open field dimension of tiny volumes of interest (VOI) the calculated MU is within an acceptable range.
Materials and Methods: Basic dosimetric measurements of wedge accessories are used to derive parameters for an innocent interpolation function for field MU value QA. All depth dose curve measurements along the wedge shape are used in a two-dimensional non-linear fit for valid parameters. The quality of the results is evaluated in terms of benign trends using slight extrapolations with tiny field dimensions of about 1cm^2. Embedded JavaScript® in PDF documents is used to generate a well accepted procedure in daily workflow[2] for routine medical physics QA. The master document is generated by utilizing LaTeX® with extensions ***hyperref***[3] and ***insdljs***[4].
Results: Within this paper an implementation based directly on linac dosimetric measurements is described. Resulting non-linear parametric fits with few parameters have been proved to be innocent even beyond the borders for limited extrapolation. This is important especially for high dose hypo-fractionated stereotactic treatment procedures based on multi-fields (≥10) and effective field areas of ≈1cm^2. Within our clinical routine workflow this form-based method is very well accepted and integrates seamless into electronic patientfolder of ROKIS[5] while documenting continuous treatment related QA.
Conclusions: The long term evaluationof an JavaScript and PDF-Document based implementation via LaTeX® is presented. The interactive tool is now in daily operation for more than two years resulting in >5000 final MU dose check documents.The discussion part of the paper also covers 'easy to use' arguments and the problem of legal issues rising from departement internal software tools.

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EP-1194